15 May 1964

MEMORANDUM FOR THE RECORD

SUBJECT: Meeting at Itek Corporation, Lexington, Mass., 11 May 1964

ATTENDING: [redacted]

25X1A

This study was an attempt to establish in fact whether or not occluding filters could be of value for edge enhancement in the field of photo interpretation. The program was divided into five distinct phases:

1. First was a theoretical approach that established values that, through mathematical calculations, provided a relative feasibility study. Computer programming determined results to be expected from spatial filtering procedures. The results agreed favorably with Mr. Swing's computations.

2. With the parameters established from the first phase, experimental verification was made using a Gaussian edge. This edge was placed in the film gate and a substantiation of the expected Fraunhofer spectrum obtained. This phase was done with a similar filtering device and not ours. Photometric results indicated increasing contrast with increasing filtersize. Because of the limited light intensity, the experiment could be carried out on only a few samples. Resulting curves were fitted and normalized.

3. The third study involved placing the Gaussian edge in the system and comparing the unfiltered image with various filters and exposures. Initially, all filters were used in this study at a fixed exposure time. The three (3) smallest filters were used also with mixed exposures. Microdensitometer edge traces were produced from each to determine maximum/minimum densities and slope. At some point, the contrast approached that of the original but did not exceed it.

4. The aerial negative was used under differing conditions such as emulsion types, apertures and filters to determine the information content (These aerial images were obtained by [redacted], and the results are included in the study). Essentially, the degraded aerial

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photography was produced through the use of various apertures, with and without haze lights and with SO243 and SO132 emulsions. The negatives, when placed in the Image Enhancement Viewer, did not produce a photograph which was improved in appearance nor could it be said that the information content was higher than before filtering. The best filtered image approached, but did not equal, the best original negative. The Image Enhancement Viewer system produced a noise amplification. Some filters produced an unevenness in the image which might have resulted from a misalinement on the filters. The new filters are spherical and epoxy-mounted on the nichrome wires whereas the old filters were round, flat and soldered to the wires.

5. The final phase was determing the system's usefulness for improving edges for mensuration purposes. This was attempted in two phases:

a. Enhancement of an object with poor definition.

b. Enhancement as applied to aerial scenes.

To accomplish this part of the study a square was photographed under different aperture conditions at medium contrast resulting in a dark square on a light background. Density of the square was approximately 1.6 and the background 0.6 (AD ~ 1.0) The Mann Comparator was used to determine dimensions. An original edge was passed unfiltered through the Image Enhancement Viewer and this edge was compared to the filtered edges. Results of comparison of edge measurements indicated that a fair approximation could be made between the filtered and unfiltered images at an f/1000 aperture. With the f/40 aperture a good approximation could be made. The precision of measurement (repeatibility) was between 10μ & 20μ on film.

During a general discussion, it was suggested that traces of filtered images and unfiltered images be included in the final report for clarification of study results. In addition, a discrepancy was noticed between the value of the "Normalized Image Coordinates" as presented in figures 4 and 6. This would be corrected no as soon as [redacted] has checked his notes. During the mensuration phase, instead of using photographs and inherent limitations in the Mann Comparator's reticule, better results might have been obtained by using the filar eyepiece for measuring the image of the filtered and unfiltered objects. This phase actually resulted in a conclusion as to measuring precision but not measuring accuracy. It was suggested that the measurements could still be made on the Itek test bench.

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[redacted] explained to the Itek personnel the problem we have had with the Image Enhancement Viewer alinement. Essentially after autocollimating the light source with the object carrier and focusing the image plane, the focal distance from the collimating lens is greater than the distance obtainable through manipulation of the object lens carrier and the image plane unit. [redacted] STATOTHR stated that they (Itek) had no problem in proper alinement of the Image Enhancement Viewer. Additional study is contemplated for this problem by the EDLB.

25X1A [redacted] suggested that the entire study could be brought to a satisfactory conclusion if Itek would propose a very modest program for the study of transmission multiplication using film samples already obtained. Optical integration would be accomplished with the Itek Image Integrator. Use of this equipment could not be programmed during the enhancement study due to limitations in time and personnel. This program would be a separate task but results could provide an answer to the feasibility of optical correlation (transmission multiplication) filtered images and the possibility of edge enhancement. Additional details on this program will be covered in their forthcoming final report.

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Development Branch, P&DS